Longevity and Color Change in the Rhinoceros Beetle, *Dynastes tityus* L. (Coleoptera: Scarabaeidae)

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The rhinoceros beetle, *Dynastes tityus* L., has been collected in both pear-green and mahogany-brown color phases. Reports of color change and variation have been made by Fattig, Hamilton, Manee, and Ritcher. Hamilton (1886) reported that he received brown male and female specimens which, after about eight weeks, changed to the usual color, i.e., green with brown spots. There have been two separate reports of color difference in individuals but without observed color change. Ritcher (1944) gave an example of 15 pupal cases containing adults which were dug from an old wild-cherry stump. "Of these, 8 individuals were spotted, 5 had one elytron spotted and the other of a solid mahogany color, and 1 beetle was of a uniform mahogany color." Manee (1915) reported having found the same type of color variation. He believed this to be an example of mimetic coloring, with the beetle taking on the color of the rotten fruit on which it fed. Color change in preserved specimens was observed by Fattig (1933). He reported that 11 of 16 specimens which had been kept under identical conditions in his collection, had changed from green with brown spots to entirely brown. The change varied between specimens, taking place either on one or both elytra or the thorax.

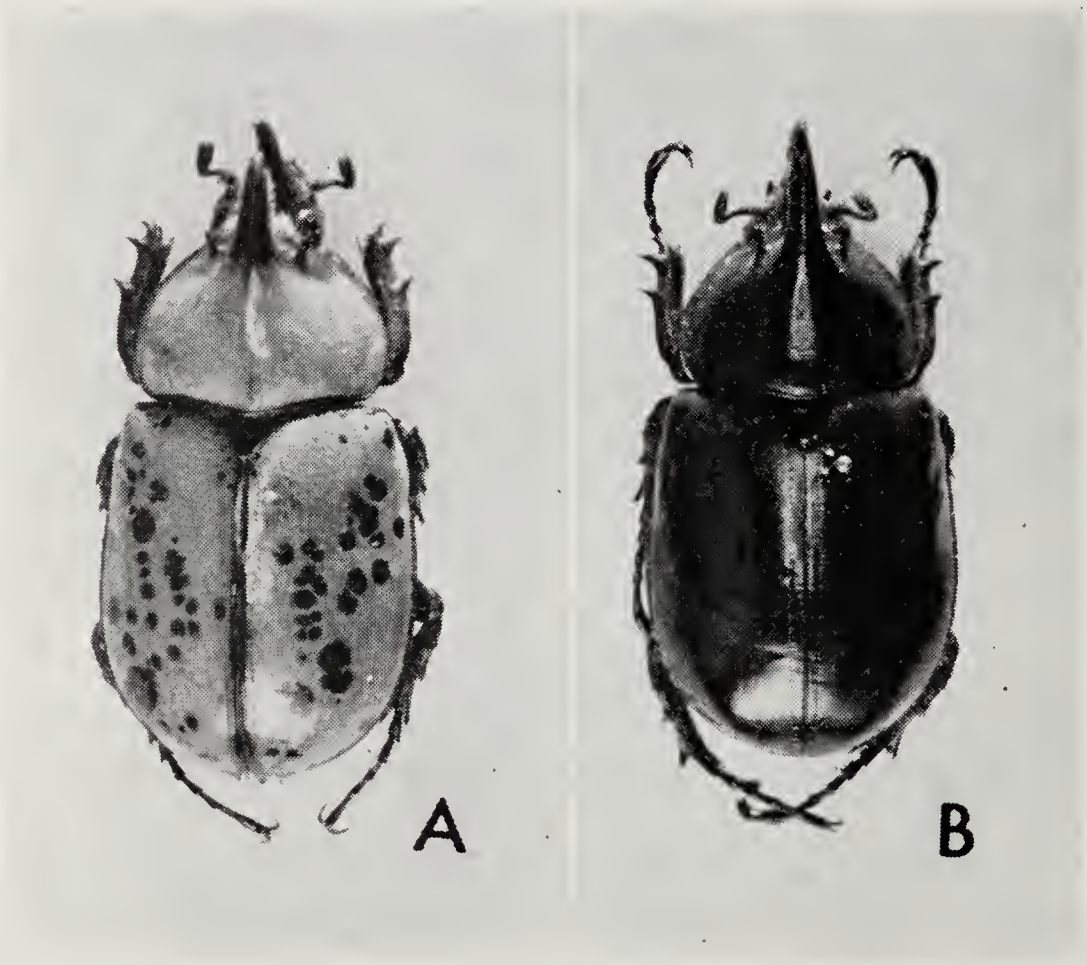

FIG. 1. Male rhinoceros beetles, *Dynastes tityus* L., showing variation in color. A. Green Phase. B. Brown phase. (Pinned specimens from the collection of Field Museum of Natural History.)

A living male, collected in Blythesville, Arkansas, by Mr. J. Branum, was given to Field Museum of Natural History on July 10, 1967. The specimen survived in our laboratory until April 2, 1968, on a diet of peaches, pears, grapes, and apples. When food was present, the beetle spent most of the time sitting on the fruit and feeding. During this period of nearly nine months, the beetle underwent several color changes. When first received, it was green with brown spots. During the first 10 days in the laboratory, while feeding continually, it slowly turned to a deep mahogany color. It was then left without food, and within three days returned to its former green color. The color extremes are shown in figure 1. During this period without food, the beetle was very active. It returned to the brown phase on two subsequent occasions, July 23 to September 20, 1967, and September 23 to 30, 1967, after a period of feeding. Each time the beetle was subsequently deprived of food, it returned to the green color in two or three days. From October 4, 1967, to April 2, 1968, the beetle was continually provided with food, and remained brown in color except for small areas of the elytra and pronotum which turned greenish. The time intervals for color phases and feeding is shown in figure 2.

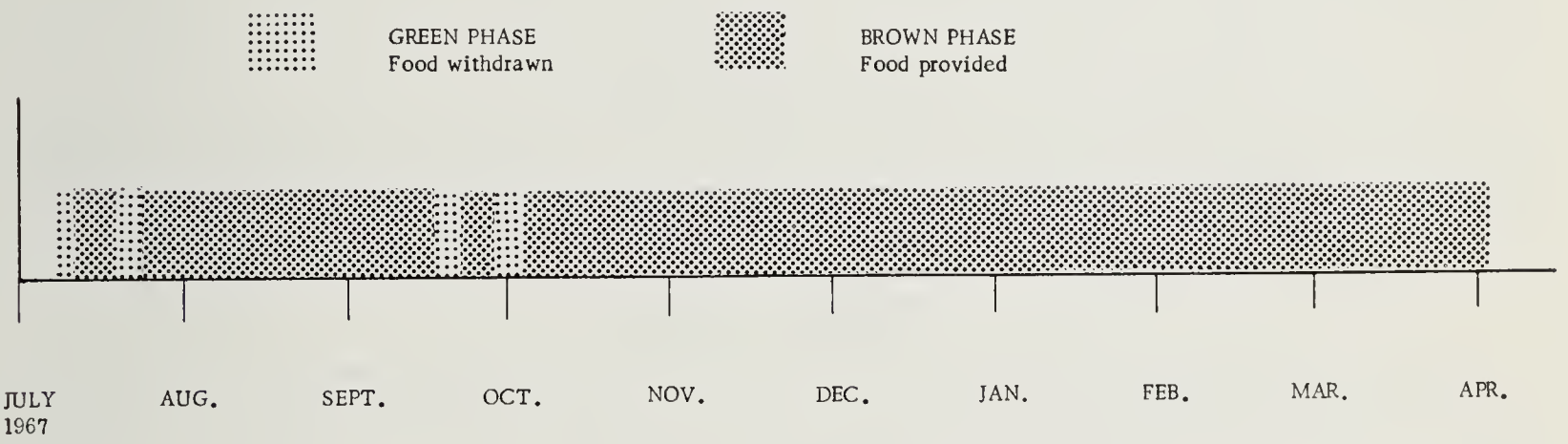

FIG. 2. Time of occurrence and duration of color change in a live specimen of *Dynastes tityus* L.; in relation to periods of feeding and food withdrawal.

Examination of the elytra of green specimens revealed that the green color is in a thin layer on the surface of the integument. This layer may be scraped off leaving a dark amber colored layer below. Without this outer layer the color will not return to green. The normally brown spots are areas that lack this green layer. Dark specimens have a characteristic wax or grease coating which seems to interfere with the green color. Degreasing with acetone or other fat solvents will restore the green color of preserved specimens. While examining preserved specimens, under 48x magnification, it was noted that the heat of a high intensity lamp promoted the movement of a fluid substance within the elytra and small area of the elytra changed to green as if drying out.

Because the living beetle's change to brown was observed during periods when it was continually provided with food, it is suggested that an increase in the fluid level during feeding, combined with the presence of fatty substances in the haemolymph may account for the change in color of the integument. If these

fats remain within the elytra after the specimens have been preserved, rises in temperature may account for color changes after death. It is hoped that this note will stimulate interest in the physiological mechanism responsible for color change. The longevity of the beetle and the ease with which it is kept alive make it a very suitable insect for laboratory studies.

Dr. Ulrich F. Danckers of River Forest, Illinois, has a small live male of *Dynastes hercules* L., obtained from a dealer, which he has kept for nearly two months on a diet of raw apples. He has noted the same kind of color changes associated with feeding and withdrawal of food.

LITERATURE CITED

FATTIG, P. W., 1933. Color changes in preserved specimens of *Dynastes tityus* (Coleop.: Scarabaeidae) Ent. News, 44: 20-21.

HAMILTON, J., 1886. Natural history notes on Coleoptera No. 2. Canadian Ent. 18: 112.

MANEE, A. H., 1915. Observations in Southern Pines, North Carolina, (Hym., Col.). Ent. News, 26: 266-268.

RITCHER, P. O., 1944. Dynastinae of North America with descriptions of the larvae and keys to genera and species (Coleoptera, Scarabaeidae). Kentucky Agric. Exp. Sta. Bull., 467: 40-42.

ACKNOWLEDGMENTS

I wish to thank Dr. Rupert L. Wenzel and Mr. Henry S. Dybas, Field Museum of Natural History, for their helpful comments and criticisms of the manuscript. I also thank Dr. Ulrich F. Danckers for notes on color change in *Dynastes hercules* L.

FIELD NOTE

Notes on Additional Distribution and Ecology of Eubrychiopsis lecontei Dietz (Coleoptera: Curculionidae.—While studying the macroinvertebrates associated with the submerged aquatic plant species *Myriophyllum spicatum* L. in Labrador Pond, Onondago County, New York, several specimens of *Eubrychiopsis lecontei* Dietz were collected. In total, 23 individuals weighing 29 mg. were taken on seven different occasions during June, July, and August of 1966. Rose Ella Warner of the Systematic Entomology Laboratory, U. S. Department of Agriculture, Washington, D. C. kindly confirmed the identification. She also stated that the species was previously unrecorded from New York, with the nearest U. S. National Museum specimens being from Detroit, Michigan (personal communication).

These organisms were identified as *Phytobius velatus* Beck. This identification is correct according to Blatchley and Leng (1916, *Rhynchophora or weevils of North Eastern America,* 682 pp.) and Leng (1920, *Catalogue of the Coleoptera of America north of Mexico.),* but this species does not occur in North America (same personal communication as above).

Labrador Pond is 150 acres in size and its deepest point is not over eight feet. The bottom consists of a soft muck, with both submerged and floating aquatics being common. *M. spicatum* probably predominates. Labrador Pond lies at the headwaters of the Chesapeake Bay drainage area, with the St. Lawrence drainage area beginning less than a mile north of the pond. This geographic distinction, alone, should encourage extensive sampling both north and south of the height-of-land that separates these two major drainage systems.

Although emphasis was placed on sampling *M. spicatum,* several other plant species were collected and none of them harbored *E. lecontei. Elodea canadensis* Michx. and *Potamogeton americanus* C. & S. are notable for their lack of *E. lecontei.* Whenever *E. lecontei* was taken they were always associated with fairly dense growths of *M. spicatum.*—JOHN N. KRULL, *Southern Illinois University, Carbondale, Illinois.*